Estimation and consultation of pain in real-time with a new system

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with the participation of France Telecom

Abstract: **We develop a new system based on WAP (Wireless Application Protocol) protocol to record and continue pain's value of patient post-operation. This system is easily to use for the patient and the portability for the clinician make it a powerful tool for pain's surveillance.**

Keywords: **WAP, Java, pain, monitoring, real time, scale, VAS..**

I. INTRODUCTION:

Numerous appliances are developed to assess pain in patients (at home for chronicle pain or in a hospital for post-operating's pain). They are reliable, robust and more or less easy to use. But their main drawback is that the information about pain is not use, by lack of interactivity between patients and clinicians. In the best case, data (pain's values acquired during the "protocol") are stored in memory and gathered at the end. It prohibits all intervention or correction on the posology by an attending clinician if values are too high. And sometimes in hospital environment, pain is not estimated by lack of time and/or medical staff. So we developed in collaboration with France Telecom (Telecommunication Operator) a system which could inform clinicians on patient's pain in real time. We use for this a WAP terminal, a web server and Java (Sun Co.) applications [1] [2] [3].

II. PATIENT INTERFACE:

We first developed WML (Wireless Markup Language) pages to be showed on portable phones. The WML pages contain a VAS (Visual Analogical Scale) (fig 1) with a moving cursor that indicates pain's value and complementary information on the patient's state e.g. nausea, vomiting…. Patient is invited to call the server by an alarm either sent by the server to his terminal, or generated locally (terminal local clock).
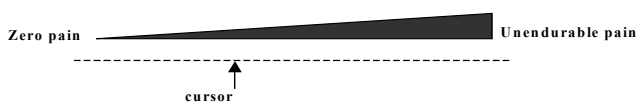

Fig 1: VAS on WAP phone programmed in WMLScript

III. SYSTEM ARCHITECTURE:

It includes:
A gateway (provided by France Telecom) , which identifies the calling terminal and translates WML information in HTTP codes.
A data base
A Web server allowing doctors to access recorded data. Values were redirected on our server where they were recorded in a database with a perl script.
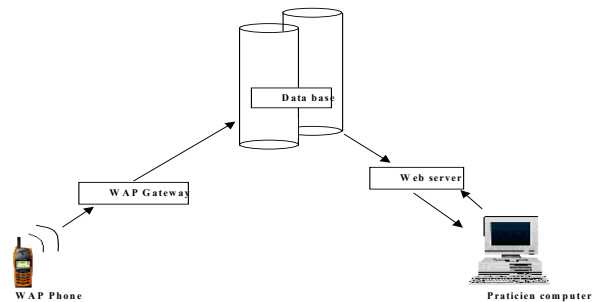

Fig 2:configuration of network

We created web pages where clinicians can connect and visual data. The visualisation of pain's values is made in a Java applet that allow to build curves from the values stored in the data-base (fig 2).
This applet allows fifty users to be simultaneously connected and a great interaction with the user. To resolve real-time problem, we built a Java servlet which has the advantage not to appeal doctor's computer memory but our server to have a faster updating. This choice was governed by the fact that communication between servlet and applet is easy. If a patient sends a new value, while his attending physician is connected, the servlet sends a message to inform the doctor of the incoming of the new data. We have also developed on the applet few statistical elements to help the clinician interpreting the data: mean data, standard deviation, area on the graph….
Different passwords guaranteed the data protection and confidentiality in accordance to code of ethics.
Furthermore, data are referenced not by the patient's name but by the phone number, and only the attending physician know which phone number corresponds to a patient.

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Abstract

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We included patients in our protocol with those criteria: age between 18-60, no psychiatrics troubles and no blindness. They used twenty mobile terminals : 10 Mitsubishi Trium Mars (small screen) and 10 Ericsson 380 (wide screen and alphanumerical keyboard).

In parallel, a nurse collected ordinary VAS values to compare with WAP VAS. A Bland and Altman test was performed on the data to provide limits of agreement between the two methods. The difference of memberships was plotted against their mean value. The mean of the differences m and their standard deviation sd were then computed (fig 3).
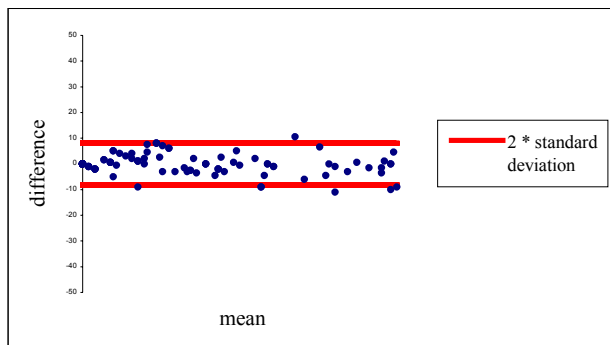

Fig 3: Bland and Altman Test

The Bland and Altman test showed us that 95% of results are in the area of convince (mean ± 2 x standard deviation). The standard deviation is 4.96 and the mean is equal to –0,08 which shows that the sloping between both methods is negligible.

It shows the precision of our measure system.

Our server shows its robustness and does not lose any information. The mean time for patients to connect and send information is equal to 1 min 30 sec. In the patient's side after the little adaptation time, terminals are user friendly and are correctly used. The possibility to use a hot-line with the same tool to send a value, gives a feeling of simplicity.

V. DISCUSSION

For the medical side, the possibility to see in "real-time" values is a great progress [4], [5]. The posology could be changed quickly if needed [6]. With the capacity to fix alarms, we developed an easy remote-monitoring (to prevent complications risks).

Few data are used in our statistical test, because nurses sometimes forget to collect data, giving reason to our free system.

VI. CONCLUSION.:

Even sent information is collected.

Data recorded are similar to another prospective EVA tool. The recording of data correspond to the actual necessity of tracking.

By developing a web visualisation we permit a great evolution of data analysis, with a simple implementation of other functions. The use of WAP allows clinicians to develop more adapted demands according to pain's value. With the next generation of WAP the push action could be used and the role of alarm will be central.

Our system is easily applicable to data heavier like chronicle's, ambulatory care,… pain and offers the possibility of multi-centric studies, it also seems to be another way to test antalgic drugs.

REFERENCES:

[1] Okamoto E, Shimanaka M "A remote monitoring system for patients with implantable ventricular assist devices with a personal handy phone system" ASAIO J, vol 45 pp194-8, 1999

[2]"UK mobile phone base station study" Health Phys, vol 79 pp442-3, 2000

[3] Edmonds M, Bauer m, Osborn S "Using the Vista 350 telephone to communicate the results of home monitoring diabetes mellitus to a central database and to provide feedback" Int J Med, vol 51 pp117-25, 1998

[4] Berg M, "Medical Work and the Computer-Based patient Record: A sociological Perspective", Meth Inf Med, vol 37, pp294-306, 1998

[5] Wyatt J "Quantitative evaluation of clinical software, exemplified by decision support systems", Int J Med Informatics, vol 47 pp165-163, 1997

[6] Inrich W, Tobisch R "Effect of mobile phone on life-saving and life sustaining systems", Biomed tech (Berl), vol 45 pp164-73, 1998